Nevada Real-Time Earthquake Network: Las Vegas Valley

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Introduction

This is a continuing phase of a larger program to install 100-station urban K-12 seismograph network at Las Vegas Valley schools.   Initially we installed 3 seismograph stations in area schools. As conceived, the network will be operated both as a research oriented modern integrated real-time system as well as a platform for K-12 science education. This is believed to a first-of-its-kind dense urban monitoring network where K-12 becomes an integral part of an overall research program. The network is designed to address the significant earthquake hazard and earthquake engineering problems that face the Las Vegas Valley.   Amplification of seismic energy in the Valley due to the thick sediment section has been estimated to be on the order of a factor 5. Also, the velocity structure of the basin, its subsurface shape and its tectonic evolution, all components to understanding the earthquake hazard, are not well understood. In addition there is notable mirco-earthquake activity in the Las Vegas area that is currently poorly monitored. This first-of-its-kind educational network will incorporate K-12 in addressing local scientific problems. This program will be an extension of an ongoing Nevada educational seismograph project.

The dense network will be implemented at a much lower cost than in standard practice because recently developed Internet communications technology can be directly integrated with monitoring systems on existing PC's. Because school PC's that are already in place on the Internet can be used for the data acquisition systems (this is the model for the Nevada Educational Seismograph Project), there is a significant cost savings in equipment purchases and installation logistics. The new software technology transmits data from the monitoring system in real-time via Internet communications protocols from the school sites to, in this case, UNLV. This Internet communications platform is the basis for real-time access to all the units that will eventually be deployed in the Las Vegas Valley. In this new model of a low cost urban K-12/research program, students and educators will be expected to operate the systems at the school level and interact with researchers to maintain a quality real-time network. Students will participate in "authentic" research. Because K-12 will be an integral part of the research program, the research community will have a vested interest in K-12. The more students and educators understand about the problems addressed, the more effective the research program will be. Maintaining an effective K-12 will be in the interest of the research community.   Ultimately, the program will include teacher and educator workshops as an avenue for primary K-12/research community interaction and development of a curriculum package to accompany the technology into the classroom. Under this science education model, motivated high-school students can be authors on scientific papers and participate in presentations at national meetings.

Install a 5 stations integrated broadband/high-frequency K-12 seismograph network in Las Vegas supplementing the existing 3 station K-12 program. The communications network for accessing schools from behind the Las Vegas School firewall has already been established. These data will be available to all participating schools as well as "any" other institution; i.e., the real-time data will be public domain. The installation of these stations will take 2 days per site. Shelley Zaragoza, UNLV undergrad, is already interacting with the current school sites and is the lead contact for new school sites. She is responsible for installation and maintaining the network. Jenelle Hopkins, UNLV MAS grad student, is developing the curriculum for the schools to be used in the classroom and at workshops.

Design

A school site is configured with a vertical component 1 Hz geophone, a 3 component digitizer that will take the signal from the seismometer and convert it to an RS-232 stream, a GPS clock for timing and PC software that accepts the RS-232 data stream and transmits the real-time waveform data to a central database at UNLV. The local PC software is able to display the real-time data from the local site as well as the real-time data from other K-12 seismographs, the regional Nevada seismic network, California seismic network stations and more than 100 stations from global seismic networks. The Las Vegas schools also have access to all USGS ANSS strong motion stations in the Valley. This system compliments the ANSS strong motion network; the strong motion network is designed for a separate scientific mission than what is planned here. All schools are able to access all of these data sources in real-time. Because of low cost systems at these sites, continued maintenance will be minimal. In fact, replacement of hardware may ultimately be less expensive than repair. Other seismometers or sensing devices can be incorporated in the network if necessary for specific research missions.

Installation

There were 20 licenses and 6 acquisition systems purchased. A MOU (memorandum of understanding) is being established through the Clark County School District for the upcoming installation. We have about 19 schools and the Red Rock visitor center that are receiving the software and 6 of the schools will receive the acquisition systems. There have been two graduate students who have been involved in the permitting and installation of these systems.

Summary

The installation of these in Las Vegas continues to increase the real-time network for southern Nevada that can not only be used by researchers, but also by the K-12 community. The stations in Las Vegas are part of a state wide initiative to connect schools to the seismology community. The students at these schools can not only see their own site, but all of the sites connected to the network. This program is showing to be an invaluable teaching tool. Our students will continue to interact with the schools for the duration that the stations are active. It will probably be several years before we see the end result of this project, but thus far it has been extremely positive for both teachers and students.